Claims

1. A process for the continuous production of polyesters (PES) by esterification/transesterification of dicarboxylic acids, preferably terephthalic acid, or esters of the dicarboxylic acids with diols, preferably ethylene glycol (EG), in at least one reaction stage, prepolycondensation of the esterification/transesterification product under a vacuum by means of a reaction stage consisting of a vertical reactor, and polycondensation of the prepolycondensation product in at least one polycondensation stage, **characterized in that** the esterification/transesterification product flowing into the vertical reactor, in which there exists a pressure of 10 to 40 % of the diol equilibrium pressure of the prepolycondensation product leaving the reactor, successively traverses in a free movement under limited heating first at least one first reaction zone formed of an annular channel, then is introduced into the radially outer or the radially inner ring duct of at least one second reaction zone formed of an annular channel divided into a plurality of concentric ring ducts, is successively passed through the ring ducts to the outlet and then into a stirred third reaction zone located at the bottom of the reactor.

2. The process as claimed in claim 1, **characterized in that** the total pressure of the reaction product at the bottom the channels of the first and second reaction zones is smaller than the local diol equilibrium pressure of the polycondensation product.

3. The process as claimed in any of claims 1 and 2, **characterized in that** the total pressure of the reaction product at the bottom of the channels of the first and second reaction zones is 5 to 80 %, preferably 10 to 70 % of the local diol equilibrium pressure of the polycondensation product.

4. The process as claimed in any of claims 1 to 3, **characterized in that** the vapors formed in the three reaction zones are jointly withdrawn from the reactor.

5. The process as claimed in any of claims 1 to 4, **characterized in that** the vapors of the first reaction zone are supplied to a separator for the entrained product droplets, before they are combined with the vapors of the two other reaction stages.

6. The process as claimed in any of claims 1 to 5, **characterized in that** the reaction product is cocurrently passed in parallel through adjacent ring ducts of the second reaction zone.

7. The process as claimed in any of claims 1 to 5, **characterized in that** the reaction product is countercurrently passed in parallel through the ring ducts of the second reaction zone.

8. The process as claimed in any of claims 1 to 7, **characterized in that** the product level of the stirred third reaction zone is controlled.

9. The process as claimed in any of claims 1 to 8, **characterized in that** the product level in the channel of the first reaction zone and in the ring ducts of the second reaction zone is kept constant.

10. The process as claimed in any of claims 1 to 9, **characterized in that** the product level in the ring ducts of the second reaction zone is lower than in the channel of the first reaction zone by a factor of 2 to 3.5.

11. An apparatus for performing the process as claimed in any of claims 1 to 10, **characterized by** a heating tube register arranged in the channel of the first reaction zone and extending in flow direction, whose tubes are retained in chambering sheets mounted transverse to the flow direction.

12. The apparatus as claimed in claim 11, **characterized by** a closed vapor collecting space mounted above the channel of the first reaction zone, whose outlet opening is connected with a separator for the entrained product droplets.

13. The apparatus as claimed in claims 10 and 12, **characterized by** an overflow baffle plate or overflow tube arranged at the end of the channel of the first reaction zone.

14. The apparatus as claimed in any of claims 10 to 13, **characterized by** an overflow baffle plate or overflow tube arranged at the end of each ring duct of the second reaction zone.

15. The apparatus as claimed in any of claims 10 to 14, **characterized in that** an underflow baffle plate or a riser is provided upstream of each overflow baffle plate or overflow tube.

16. The apparatus as claimed in any of claims 10 and 12, **characterized by** a gooseneck outlet with drainage bypass and vent tube each arranged at the deepest point of the bottom at the end of the channel of the first reaction zone or at the end of the last ring duct of the second reaction zone.

17. The apparatus as claimed in any of claims 10 to 16, **characterized by** a drainage opening each located at the deepest point of the bottom at the end of the channel of the first reaction zone or at the end of each ring duct of the second reaction zone.

18. The apparatus as claimed in any of claims 10 to 17, **characterized in that** guide plates are arranged in the ring ducts of the second reaction zone.

19. The apparatus as claimed in any of claims 10 to 18, **characterized in that** the bottom of the channel of the first and/or second reaction zone is inclined at an angle of 0.5 to 6°, preferably 1 to 4° with respect to the horizontal plane.

20. The apparatus as claimed in any of claims 10 to 19, **characterized in that** the stirrer for the third reaction zone consists of a ground-running impeller, finger, frame or drum stirrer, each with a vertical drive axle.

21. The apparatus as claimed in any of claims 10 to 20, **characterized in that** the stirrer for the third reaction zone includes a rotary-disk stirrer or a cage stirrer, each with a horizontal drive axle.

22. The apparatus as claimed in claim 21, **characterized in that** the rotary-disk stirrer is equipped with perforated, ring or solid disks.

23. The apparatus as claimed in claim 22, **characterized in that** in a rotary-disk cascade the inlet for the reaction product is half mounted at each of the axial ends, and the common outlet is mounted in the middle.

24. The apparatus as claimed in claim 22, **characterized in that** in the rotary-disk cascade with perforated disks the inlet for the reaction product is mounted at the one end and the outlet is mounted at the opposite end.

25. The apparatus as claimed in any of claims 10 to 22, **characterized by** one stationary partial stream drainage each mounted at the bottom at the ends of the channels and of the ring ducts.